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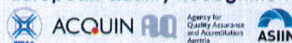


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antioxidative peptides (fAY and fHL) were exclusive identified in α_{s1} -casein B. This confirms that genetic variants of camel casein are a source of different bioactive peptides as already described in cattle (Weimann et al., 2009) and reveals the additional potential of milk protein variants for human health.

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LOW MILK CHOLESTEROL IN CAMEL MILK: TRUE OR NOT?

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Abstract

Many authors argue that camel milk contains less cholesterol than cow milk while other reported the reverse. To compare the cholesterol content in camel and cow milk in similar farming conditions and to assess the impact of short underfeeding on cholesterol concentration in milk and serum, seven cows and seven camels were sampled (milk and blood) at the middle of lactation at morning and evening milking, then two weeks after distribution of low energy-protein diet, another sampling was achieved. Cholesterol content in camel milk (5.64 ± 3.18 mg $100g^{-1}$) was lower than in cow (8.51 ± 9.07 mg $100g^{-1}$), but the difference was not significant. Moreover, the ratio cholesterol/fat was similar in the two species (225 ± 125 mg $100g^{-1}$ fat in camel and 211 ± 142.4 mg $100g^{-1}$ fat in cow). Serum cholesterol concentration was significantly higher in cow (227.8 ± 60.5 vs 106.4 ± 28.9 mg $100mL^{-1}$). There was significant difference between morning and evening milking in milk fat composition and concentrations in cholesterol. The present study showed that cholesterol concentration in camel serum is lower than in cow in similar feeding and environmental conditions, but further researches are needed to demonstrate the relationship between feeding and cholesterol content in camel milk.

Key words: camel milk, cholesterol, serum, low diet

ТҮЙЕ СҮТІНДЕГІ ХОЛЕСТЕРОЛ ДЕҢГЕЙІ ТӨМЕН: РАС ПА?

Көптеген авторлар түйе сүтіндегі холестерол пайызы сиыр сүтіне қарағанда төмен деген дәлел келтіруде, осы орайда кейбірі бұл дәлелмен келіспеуде. Түйе мен сиыр сүтіндегі холестерол санын салыстыру мақсатында бірдей шаруақожалық жағдайында және қысқа толық қорек бермеудің итеруін сүт пен оның ерітіндісінің холестерол санын бағалауда, 7 сиыр мен 7 түйенің орта лактация кезеңінде, яғни таңғы және түскі сауу ортасында қаны мен сүтінен сынамалар алынды, кейін төменгі ақуыздық диетаның төмендеуі 2 апта таралғаннан кейін, басқа сынамаларда соңына жетті. Түйе сүтіндегі холестерол саны (5.64 ± 3.18 мг 100 г-1) сиыр сүтіне қарағанда біршама төмен болды (8.51 ± 9.07 мг 100 г-1). Қалай дегенде, екі сынамадағы холестерол мен майдың ара қатынасы шамалас болды (225 ± 125 мг 100 г-1 май түйеде және 211 ± 142.4 мг 100 г-1 май сиырда). Холестеролдың саны сиыр сүтінде біршама жоғары болды ($227.8 \pm 60.5 / 106.4 \pm 28.9$ мг 100 мл-1). Таңғы және кешк сауу арасында алынған сүт майының саны мен холестерол мөлшерінде біршама маңызды айырмашылық болды. Аталмыш мәліметтер бірдей қоршаған орта жағдайы мен қоректендіруде түйе сүтіндегі холестерол саны сиыр сүтіне қарағанда төменірек екендігін көрсетті. Ендігі кезекте зерттеушілерге түйе сүтіне тамақтандыру мен холестерол санының ара қатынасының қатысын көрсетуі қажет.

Түйін сөздер: түйе сүті, холестерол, ертінді, құнарлығы аз диета

НИЗКОЕ СОДЕРЖАНИЕ ХОЛЕСТЕРОЛА В ВЕРБЛЮЖЬЕМ МОЛОКЕ: МИФ ИЛИ НЕТ?

Многие авторы оспаривают утверждение о более низком содержании холестерина в верблюжьем молоке по сравнению с коровьим, тогда как другие утверждают обратное. Для исследования и сравнения содержания холестерина при одинаковых условиях содержания и небольшого недокорма были отобраны две группы по семь верблюдиц и семь коров, в середине периода лактации, от которых отбирались пробы молока и крови на утренней

и вечерней дойке, затем через две недели низко-протеиновой диеты серия заборов проб была повторена. Содержание холестерина в верблюжьем молоке (5.64 ± 3.18 мг 100г⁻¹) было ниже чем в коровьем молоке (8.51 ± 9.07 мг 100г⁻¹), но разница была незначительна. Более того, соотношение холестерол/жиры совпадало для обоих животных (225 ± 125 мг 100г⁻¹ жиров у верблюдиц и 211 ± 142.4 мг 100г⁻¹ жиров у коров). Содержание холестерина в сыворотке у коров было значительно выше у коров (227.8 ± 60.5 vs 106.4 ± 28.9 мг 100мл⁻¹). Отмечена значительная разница в содержании холестерина между утренней и вечерней дойками. Настоящее исследование показывает, что содержание холестерина в сыворотке верблюжьего молока ниже чем в сыворотке коровьего при одинаковых условиях содержания, но необходимы дополнительные исследования для выявления зависимости между условиями содержания и кормлениями и содержанием холестерина в верблюжьем молоке.

Ключевые слова: верблюжье молоко, холестерол, бедная диета

Introduction

Cholesterol is a sterol commonly present in milk and meat products intended for human consumers. As the nutritionists claimed, for long time, relationships between high blood cholesterol concentration and heart failure, many medical advices push to reduce the cholesterol intake, even if the effect of cholesterol on health is not clarified (Alabdulkarim et al., 2012). Although everyone agrees on the low cholesterol level of camel meat compared to other species (Kadim et al., 2008), the situation is controversial for camel milk. Many scientists argue that camel milk contains less cholesterol than cow milk (Kamal and Salama, 2009; Raziq et al., 2008) while others reported the reverse (Gorban and Izzeldin, 1999; Konuspayeva et al., 2008). The objective of the present paper was, thus, to compare the cholesterol contents in camel and cow milk produced under similar farming conditions and to assess the impact of low protein diet on the cholesterol concentration in milk and serum.

Materials and methods

Seven Holstein cows (5 to 9 years old, average weight 420 kg, middle stage just after lactation peak) and 7 she-camels (6 to 12 years old, average weight 650 kg, middle stage of lactation), belonging to the Camel project, Kharij (Saudi Arabia), were used. Before the experiment, the camel produced 6.6 liters/day and the cow 15.4 liters/day. Cows and camels were milked twice a day by milking machine. Cows were given a daily ration of 15 kg of Rhodes grass hay (*Chloris gayana*), 7.5 kg concentrates (18% crude proteins), while camels were provided 12 kg alfalfa (*Medicago sativa*) and 3 kg concentrates. All animals received in addition CMV (100g/day/animal). Experimental animals were given low energy diet (concentrate decreased 50) for 21 days after the collection of the first milk/blood samples. The quantity of milk expected according to energy level with normal diet was 6.3 kg/day for camel and 9.9 kg/day for cow. With low-energy diet, these values were 5.3 and 7.2 kg/day respectively. The values based on the protein level of the diet were 9.8 and 18.3 kg/day with normal diet (camel and cow respectively) and 7.5 and 12.3 kg/day with low diet (camel and cow respectively).

The experiment included two steps for sampling: (i) Milk and blood samples of each cow and camel at the morning and afternoon milking at day 1. All animals received their normal diet described above, (ii) Milk and blood sampling of the same cows and camels at day 21 after two weeks of distribution of low-energetic diet described above. Finally, 56 milk samples and 56 blood samples were analyzed (28 cow and 28 camel samples for milk or blood collected at milking time). Milk samples were analyzed at IDAC laboratory (Saudi Arabia) for cholesterol (AOAC-994.10 method, 2010) and fat (AOAC-989.05 method, 1996) contents. The blood samples were centrifuged (5000 rpm; 30 min) to separate serum and total cholesterol was determined directly by a Biochemist analyzer KENZA Max (Biochemis TRY, BIOLABO®, Maizy, France) by using Biolabo kit (n°LP80106) based on CHOD-PAP method.

To assess the differences in the cholesterol values between camel and cow milk and serum, then within species between milking time and between diets, one-way analysis of variance (ANOVA) was used.

Results and discussions

Average cholesterol contents in camel milk were lower (5.64 ± 3.18) than in cow milk (8.51 ± 9.07 mg/100g) but the difference was not significant. The variability was higher in cow (coefficient of variation, CV 107) than in camel milk (CV 55). Fat content in camel (2.69 ± 0.98 g/100g) was significantly lower ($P < 0.001$) than in cow milk (4.52 ± 3.36 g/100g). Camel (225 ± 125 mg/100g fat) and cow (211 ± 142.4 mg/100g fat) milk maintained almost similar cholesterol/fat ratios. Our values in both cow and camels are lower than in the literature, but reported to the fat content of the milk, the difference was less marked. Gorban and Izzeldin (1999) reported total cholesterol in camel milk of 31.3 mg/100ml, and 25.6 mg/100ml in cow milk, and the proportion of total cholesterol to total lipid was reported to 0.93% in camel compared to 0.69% in cow milk. In dromedary and Bactrian camels from Kazakhstan, the mean value of cholesterol in milk was reported 37.1 mg/100ml (Konuspayeva et al., 2008), but the animals had a high level of fat in milk (5.9%). In clear, the milk cholesterol level being closely dependent of the quantity of fat matter, it is not possible to affirm that camel milk is less or more rich in cholesterol than cow milk.

Cholesterol content was significantly lower ($P < 0.05$) in the morning milking than in the afternoon milking in cow milk (5.04 ± 4.41 and 12.64 ± 11.0 mg/100g, respectively) contrary to camel where no significant difference was observed (4.97 ± 2.84 and 6.31 ± 3.45 mg/100g respectively). Such difference between milking time was already described in dairy cows (Lakic et al., 2011). In all the cases, the fat content was higher in evening milking than in morning. In consequence, the cholesterol content was increased also, the ratio cholesterol/fat being similar whatever the time of milking.

In spite of higher mean values in cholesterol content after one week low diet distribution, the differences were not significant both in camel (4.71 ± 3.73 vs 6.57 ± 4.09 mg/100g with normal and low diet respectively) and in cow milk (6.77 ± 6.38 vs 10.91 ± 11.0 mg/100g). The ratio cholesterol/fat in milk did not change significantly whatever the milking time or the type of diet. The fat content in milk was higher with low diet in cow compared to normal diet (5.93 ± 3.88 g/100g vs 3.10 ± 2.02 g/100g respectively), while no change was observed in camel (2.70 ± 1.25 vs 2.69 ± 0.66 g/100g, respectively). The milk production was decreased by 19 % in camel after low diet distribution and by 30% in cow. The source of fat in the diet could have an effect on cholesterol status of farm animals, especially by modulating its content in milk (Reklewska et al., 2002). The increase of fat concentration in cow milk after two weeks of low diet distribution was not observed in camel. It is known that camel is less sensitive to a small shortage of food and that he can maintain both the milk production and composition after fasting contrary to cow which decreases drastically its milk production.

In serum, the cholesterol was almost 2 times higher in cow (227.8 ± 60.5 mg/100ml) than in camel (106.4 ± 28.9 mg/100ml) ($P < 0.001$). There was no difference in serum cholesterol between morning and afternoon sampling both in camel and cow. At reverse, the diet had a significant effect ($P < 0.05$) on the serum cholesterol increase (154 ± 77.6 mg/100 ml vs 180 ± 75.8 mg/100ml in normal and low diet respectively). However, in spite of the same trend, this difference did not appear significant within each species. The values in cow serum in our study were on average comparable to those reported in the literature. In camel, the references were scarce. In Djibouti, Faye and Mulato (1991) reported low values in camel compared to cattle in extensive systems: 19.5 mg/100ml on average with range 9-52 mg/100ml. Globally the level of cholesterol in serum is linked to the dairy yield (Fayet et al., 1986). The diet contributing to increase the milk production (for example supplementation with high energy-protein) is linked to the increasing of glycaemia, and glucose is one of the main precursors for cholesterol synthesis in the small intestine or liver.

In conclusion, the cholesterol in milk depending on the fat content, the probable low cholesterol content in camel milk is not a characteristic of the species

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LIPIDS COMPOSITION OF SUDANESE CAMEL BONE MARROW

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Abstract

Lipid composition of bone marrow in various species of animal has been investigated in various species of animals, but is lack of information about lipid composition of bone marrow of *Camelus dromedarius*. The fatty acids composition of four camel's bone marrow samples from different regions of Sudan were determined in two camel breeds, Butana breed camel and Kassala camel breed were analyzed for 37 fatty acids profile by gas chromatography and were confirmed by mass spectrometry for each lipid sample. It was found that Tricosanoic acid was high in Butana camel breed (10.53 mg/l) than Kassala camel breed (10.33 mg/l), while Lauric acid was high in Kassala breed (4.81 mg/l) than in Butana camel breed (1.04 mg/l). Whereas, Caproic acid was found in Butana camel breed (0.6 mg/l). It was concluded that camel bone marrow lipid differed from mammalian. Slight differences in fatty acid composition occurred between breeds.

Keywords: Bone Marrow, Fatty acid esters, Camel, Sudan.

СУДАН ЕЛІНІҢ ТҮЙЕЛЕРІНІҢ СҮЙЕК КЕМІГІНІҢ ЛИПИДТІК ҚҰРАМЫ

Алуан түрлі жануарлардың сүйек кемігінің липидтік құрамы зерттелген, алайда дромедар (*Camelus dromedarius*) түйелерінің сүйек кемігінің липидтік құрамы туралы мәлімет тапшы.

Судан мемлекетінің кейбір аумақтарының (Бутана, Кассала) тұқымынан алынған әрбір үлгінің, май қышқылдарының 37 профилі газдық хроматографпен және масс-спектрометриясымен анықталды.

Нәтиже көрсеткендей Кассала тұқымына (10.33 мг / л) қарағанда Бутан тұқымының трикозандық қышқыл құрамы (10.53 мг / л) жоғары болды, ал лаурин қышқылының мөлшері Кассала тұқымында (4.81 мг / л) жоғары болды Бутанға қарағанда (1.04 мг / л). Капронды қышқыл тек Бутан тұқымында (0,6 мг / л) кездесті. Қорыта келе, түйелердің сүйек кемігінің майлары басқа сүтқоректі жануарларға қарағанда ерекшеленетіні анықталды және тұқым арасында сүйек кемігіндегі май қышқылдарының құрамында ерекшелінетіні анықталды.

Түйін сөздер: сүйек кемігі, май қышқыл эфирі, түйе, Судан